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Giambattista Bello (*)

Stomach content of a specimen of *Stenella coeruleoalba* (Cetacea: Delphinidae) from the Ionian Sea

Abstract — The stomach of a striped dolphin, *Stenella coeruleoalba,* stranded on the coast of the Gulf of Taranto (North Ionian Sea) contained remains of 97 prey items: 73 cephalopods belonging to the species *Heteroteuthis dispar, Onychoteuthis banksii, Ancistroteuthis lichtensteinii, Histioteuthis reversa,* and *Todarodes sagittatus;* 16 *Chauliodus sloani* specimens and 5 other teleostan fishes; and 3 shrimps belonging to *Pasiphaea multidentata* and *Sergia robusta.*

Riassunto — Contenuto stomacale di un esemplare di *Stenella coeruleoalba* (Cetacea: Delphinidae) del Mar Ionio.

Una stenella, *Stenella coeruleoalba,* spiaggiata sulla costa del Golfo di Taranto, conteneva nello stomaco i resti di 97 prede: 73 cefalopodi, appartenenti alle specie *Heteroteuthis dispar, Onychoteuthis banksii, Ancistroteuthis lichtensteinii, Histioteuthis reversa* e *Todarodes sagittatus;* 16 esemplari di *Chauliodus sloani* e 5 di altri teleostei; 3 crostacei delle specie *Pasiphaea multidentata* e *Sergia robusta.*

Key words: Stomach content, *Stenella coeruleoalba,* Cetacea, Cephalopoda, Ionian Sea.

Introduction

The striped dolphin, *Stenella coeruleoalba* (Meyen, 1833), a cosmopolitan species, is the most common cetacean in the Mediterranean and is the dolphin most frequently stranded along the Italian (Cagnolaro *et al.,* 1986; Centro Studi Cetacei, 1987 and 1988) and other Mediterranean coasts (Duguy *et al.,* 1979).

(*) Laboratorio Provinciale di Biologia Marina - Molo Pizzoli, 70123 Bari, Italy.

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Regarding its feeding habits, Cagnolaro *et al.* (1983) refer that *S. coeruleoalba* feeds on small sized blue fish and cephalopods; Duguy *et al.* (1979) state that this species is much more teuthophagous than previously thought. According to Viale (1985) *S. coeruleoalba* can be listed among the «preferentially teuthophagous cetaceans». Cagnolaro *et al.* (1986) found that striped dolphin stomachs contained remains of cephalopods and fishes.

Detailed food item lists for *S. coeruleoalba* are given by Desportes (1985) and Wurtz & Marrale (1991). Desportes (*op. cit.*) studied a few dozens of specimens from the French Atlantic and Mediterranean coasts; bony fishes and cephalopods constituted 70% and 30% of their diet. Wurtz & Marrale (*op. cit.*) examined the gastric content of 19 striped dolphins from the Ligurian Sea; their taxonomic list includes 9 cephalopod, 6 teleost and 3 shrimp species. They state that «bony fishes were the main food item».

As regards to extra-Mediterranean populations of *S. coeruleoalba,* Miyazaki *et al.* (1973) give a list of food items found in the stomach of 27 specimens taken from Sagami Bay, Japan (Pacific Ocean). They found that cephalopods ranked third in terms of number of specimens eaten, after fishes and shrimps. Only 2% of the cephalopods (36/1840) were identified to the species level.

This paper reports the analysis of the stomach content of a *S. coeruleoalba* specimen stranded on the Apulian coast of the Ionian Sea. It is the first report for the eastern Mediterranean and, as such, brings valuable information. As stressed by Viale (1985), the impossibility of collecting cetaceans at will compels the use of single specimens to further our cetological knowledge.

Materials and methods

The stomach content was taken from a *Stenella coeruleoalba* specimen stranded on a beach by Castellaneta Marina, about 30 Km west of Taranto (Gulf of Taranto, North Ionian Sea). The specimen was found dead on the morning of May 9th 1989; it had possibly died either during the night or early in the morning (Pastore, pers. comm.). It was a female 2.0 m long.

The author received the gastric content, fixed in 10% formalin, a few hours after the dolphin autopsy, on July 13th 1989. The material was sorted out and each food item identified to the lowest possible taxon. The identification of cephalopod beaks was done according to Clarke (1986) and by comparing them with beaks from fully identified specimens.

The number of prey specimens was established by conservative count of both whole bodies and loose parts and represents the highest reliable number.

Food items were divided into three digestion categories. A: early digestion stages, animals identifiable by soft tissue characters; B: advanced digestion stages, soft tissue remains useless for identification; C: hard part remains only (cephalopod beaks, gladii and lenses; fish skeletal fragments, scales and otoliths).

Prey item size was directly measured whenever possible. Otherwise hard part remains were used to estimate prey size. Cephalopod mantle length (ML) and weight (W) were estimated (EML and EW) by lower beak

rostral length (LRL). In the case of *Todarodes sagittatus, Onychoteuthis banksii,* and *Histioteuthis reversa,* the regression equations reported by Clarke (1962 and 1986) were used; in the other cases (i.e. *H. dispar* and *A. lichtensteinii*), ML and W were roughly estimated by simple proportion with beaks extracted from specimens of known ML and W. *Chauliodus sloani* total length estimation was made by the ratio 'mandible length/total length' taken from the species figure in Gibbs (1984).

Results

In all, 97 food items were counted: 21 teleostan fishes, 3 shrimps, and 73 cephalopods. Table 1 gives the taxonomic list of the prey items, prey number, digestion stage, and estimated weight for cephalopods.

Table 1 – Prey species and number in the stomach of *S. coeruleoalba.* Row A = number of specimens in early digestion stages; row B = number of specimens in advanced digestion stages; row C = number of specimens represented by hard parts only; EW = estimated weight for cephalopods (* = actual weight for crustaceans).

	digestion stage A	B	C	EW (g)
OSTEICHTHYES	Total number = 21			
CHAULIODONTIDAE				
Chauliodus sloani Schneider, 1801	—	—	16	
unidentified teleosts	—	—	5	
CRUSTACEA	Total number = 3			
PASIPHAEIDAE				
Pasiphaea multidentata Esmark, 1866	2	—	—	12*
SERGESTIDAE				
Sergia robusta (Smith, 1881)	1	—	—	1*
CEPHALOPODA	Total number = 73			584
SEPIOLIDAE				
Heteroteuthis dispar (Rüppell, 1844)	15	—	23	43
ONYCHOTEUTHIDAE				
Onychoteuthis banksii (Leach, 1817)	24	—	—	230
Ancistroteuthis lichtensteinii (Férussac, 1848)	—	3	—	51
Onychoteuthid sp.	—	1	—	10
HISTIOTEUTHIDAE				
Histioteuthis reversa (Verrill, 1880)	—	—	5	160
OMMASTREPHIDAE				
Todarodes sagittatus (Lamarck, 1798)	—	2	—	90
Overall total number = 97				

Teleosts

Chauliodus sloani. Sixteen specimens. Only skeletal parts were found, including dental bones. Estimated total lengths ranged from 12 to 20 cm.

Unidentified species. Vertebrae and head bones from 5 specimens belonged to 3 unidentified teleost species. All specimens were small sized; mandibles ranged from about 0.5 to 1 cm.

Crustaceans

Total actual weight: 12.9 g.

Pasiphaea multidentata. Two fragmented adult specimens. Carapace length: 24 and ca. 25 mm; total weight: 11.9 g.

Sergia robusta. One specimen broken into two parts. Carapace length: 16.4 mm; weight: 1.0 g.

Cephalopods

Total actual weight: 202.5 g.

Heteroteuthis dispar. Thirty-eight specimens. Fifteen specimens at early digestion stage; ML range: 14 to 17 mm. Hard part remains for 23 specimens; LRL range: 0.82 to 1.06 mm. The LRL distribution resulted unimodal (Fig. 1).

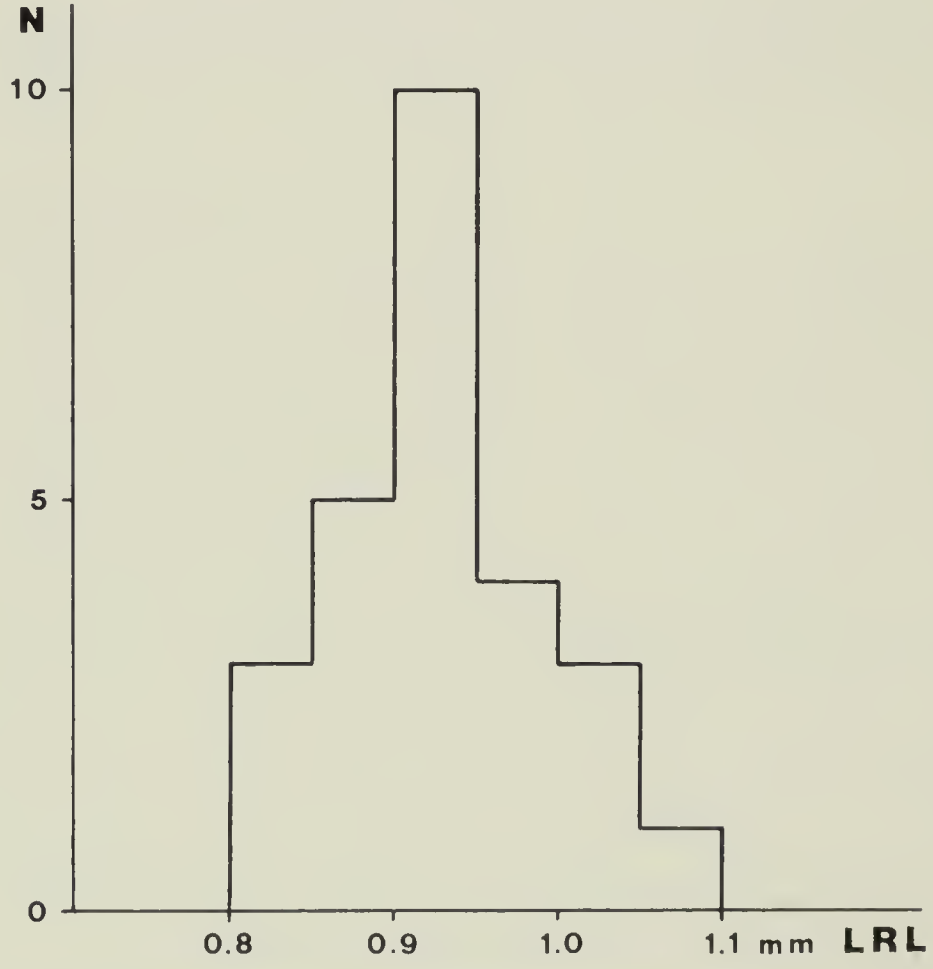

Fig. 1 — LRL frequency distribution for *Heteroteuthis dispar*; N = 26.

Onychoteuthis banksii. Twenty-four specimens. ML of 19 specimens ranged from about 45 to 89 mm; their distribution resulted unimodal (Fig. 2).

Ancistroteuthis lichtensteinii. Three fragmented specimens. LRLs = 2.7, 3.1, and 3.2 mm. EML range: 6.5 to 9 cm.

Unidentified onychoteuthid. One arm crown without buccal mass could not bo identified to the species level.

Histioteuthis reversa. Five pairs of beaks. LRLs = 2.0, 2.2, 2.3, 2.4, and 2.5 mm. EML range: 4.5 to 6 cm.

Todarodes sagittatus. Two fragmented specimens. LRLs = 2.4 and 3.3 mm. EMLs = 8.8 and 12.5 cm.

Prey item grouping by digestion stage

Taking into account both their digestion stage and size, prey items were divided into groups, so that each one included preys ingested at about the same time. Therefore such groups represent «discrete meals».

Group no. 1 (very last meal before stranding): 24 *O. banksii,* 15 *H. dispar,* and 3 crustacean specimens. Estimated total weight: 260 g.

Group no. 2: 3 *A. lichtensteinii,* 1 unidentified onychoteuthid, and 2 *T. sagittatus* specimens. Estimated total weight: 151 g.

Group no. 3: only hard part remains; 21 teleost, 23 *H. dispar,* and 5 *H. reversa* specimens. All hard part remains had not resided for a long time

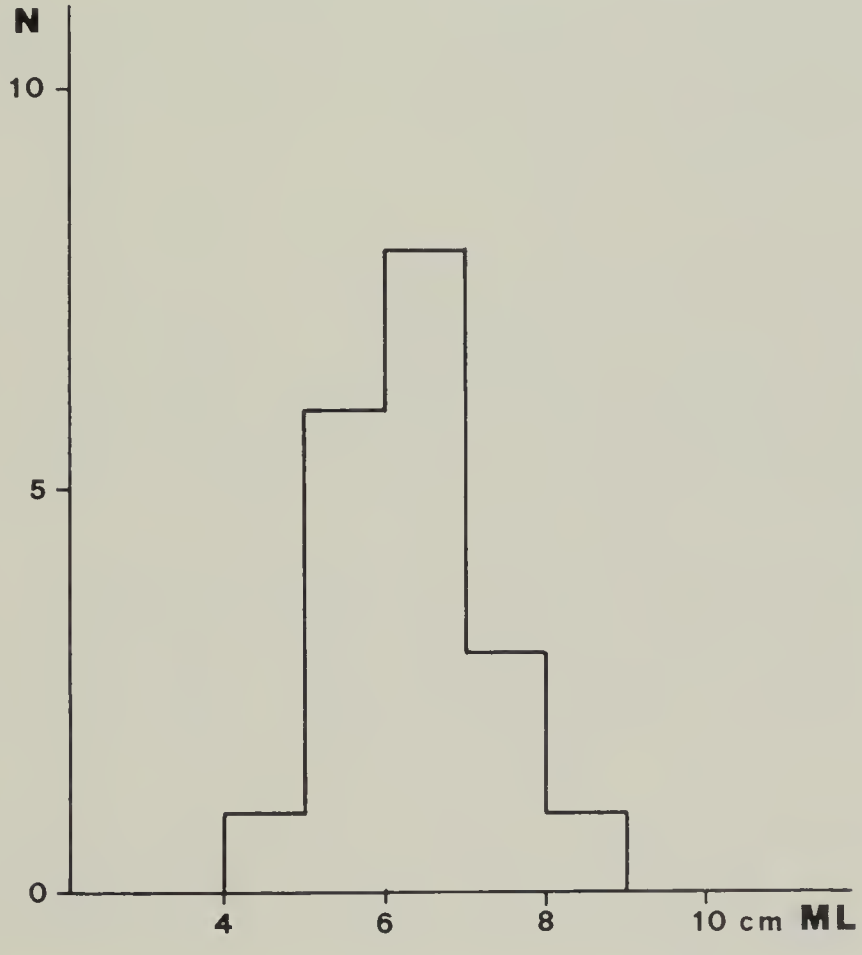

Fig. 2 – ML frequency distribution for *Onychoteuthis banksii*; N = 19.

in the dolphin stomach. For instance, the very delicate *H. dispar* beaks had not been affected yet by the digestive process, their transparent wings being still in place. Estimated total weight for cephalopods only: 186 g.

Discussion

The stomach content composition of the specimen from the Gulf of Taranto agrees with the placement of *S. coeruleoalba* among the «preferentially teuthophagous cetaceans» (Viale, 1985). However, both inside and outside the Mediterranean, this species proved to be rather generalist and to prefer either fish (Desportes, 1985; Wurtz & Marrale, 1991) or fish and crustaceans (Miyazaki *et al.,* 1973). The discrepancy between these results and those of the mentioned authors is even more striking when considering that the fraction of cephalopods in the striped dolphin diet reaches a minimum just in spring (Desportes, 1985).

The dolphin had taken discrete meals. Taking into consideration the information about digestion processes in another delphinid species, i.e. *Globicephala melaena,* (Desportes, 1985), it appears that the last two meals (prey groups nos. 1 and 2) had been ingested a comparatively short time apart from each other (several tens of minutes); whereas the previous meal(s) (prey group no. 3) had been taken several hours before.

A large fraction of identified prey specimens (87%) belonged to bioluminescent species (*Heteroteuthis dispar, Histioteuthis reversa, Onychoteuthis banksii, Chauliodus sloani,* and *Sergia robusta*). Miyazaki *et al.* (1973) also stress the presence of a high fraction (74%) of prey items with luminous organs; 44% of cephalopod specimens found in Ligurian striped dolphin stomachs belonged to luminescent species (Wurtz & Marrale, 1991). This phenomenon suggests that *S. coeruleoalba* might use its sight, in addition to its sonar system, to detect small luminescent prey in the dark. As reported in the Materials & Methods section, the dolphin death occurred either during the night or early in the morning. Therefore, at least one of its last meals had been taken in the dark. Norris (1991) refers that spinner dolphins, *Stenella longirostris,* — a closely related species — feed at night-time and catch their «tiny food by means of their echolocation or perhaps by watching the lights of the fishes themselves». However, see Young & Roper (1976) and Young *et al.* (1980) about concealment by counterillumination.

Concerning prey habitat and *S. coeruleoalba* feeding depth, all prey species are oceanic (indeed *Pasiphaea multidentata* is benthopelagic between 200 and 2,000 m (Holthuis, 1987)). Thus, this dolphin had fed in midwater. The fact that *C. sloani,* the prey cephalopods and crustaceans carry out dial vertical migrations, moving towards the surface at night-time (Gibbs, 1984; Clarke, 1966; Roper, 1974; Froglia & Giannini, 1982), complicates the interpretation of the striped dolphin feeding depth range.

Chauliodus sloani, a cosmopolitan species, is fairly common in the Gulf of Taranto (Pastore, 1976 and pers. comm.). It is also a preferential prey of *S. coeruleoalba* from Japan (Miyazaki *et al.,* 1973) and was identified in the stomach content of Ligurian striped dolphins (Wurtz & Marrale, 1991).

The shrimps *P. multidentata* and *S. robusta* are found all over the Mediterranean (Holthuis, 1987; Froglia & Giannini, 1982); the former species was

also obtained from Ligurian striped dolphin stomachs (Wurtz & Marrale, 1991).

The cephalopod species found in the dolphin stomach are widely distributed in the Mediterranean (Mangold & Boletzky, 1987); they were also recorded for the Gulf of Taranto (Bello, 1987). All five species were found in the gastric contents of large pelagic predators caught in the Gulf of Taranto and the North Ionian Sea, i.e. swordfish, *Xiphias gladius,* (Bello, 1991) and blue sharks, *Prionace glauca,* (Bello, 1990). Four of them, i.e. *H. dispar, A. lichtensteinii, H. reversa,* and *T. sagittatus,* are reported in the list of Ligurian striped dolphin prey items (Wurtz & Marrale, 1991). Therefore, it appears that those cephalopods play an important role in Mediterranean oceanic food webs.

The unimodal size frequency distributions of *H. dispar* and *O. banksii* (Figs. 1 and 2) show that their preyed upon shoals were possibly composed of single cohort individuals.

The cephalopod, crustacean, and fish species ingested by the examined striped dolphin are rarely caught by fishermen and most of them have no commercial value. Therefore, as regards to those species at least, there is no competition between dolphins and fishermen.

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Bibliography

Bello G., 1987 - Elenco dei Cefalopodi del Golfo di Taranto. *Atti Soc. Ital. Sci. Nat. Mus. Civ. St. Nat. Milano,* 128: 173-179.

Bello G., 1990 - Cephalopod remains from Blue Sharks, *Prionace glauca,* caught in the Gulf of Taranto. *Rapp. Comm. int. Mer Médit.,* 32, 1: 242.

Bello G., 1991 - Role of Cephalopods in the diet of the swordfish, *Xiphias gladius,* from the eastern Mediterranean Sea. *Bull. Mar. Sci.,* 49: 312-324.

Cagnolaro L., Cozzi B., Magnaghi L., Podestà M., Poggi R. & Tangerini P., 1986 - Su 18 Cetacei spiaggiati sulle coste italiane dal 1981 al 1985. Rilevamenti biometrici ed osservazioni necroscopiche (Mammalia Cetacea). *Atti Soc. Ital. Sci. Nat. Mus. Civ. St. Nat. Milano,* 127: 79-106.

Cagnolaro L., Di Natale A. & Notarbartolo di Sciara G., 1983 - Cetacei. Guide per il riconoscimento delle specie animali delle acque lagunari e costiere italiane, 9. *C.N.R.,* Roma: 185 pp.

Centro Studi Cetacei, 1987 - Cetacei spiaggiati lungo le coste italiane. I. Rendiconto 1986. *Atti Soc. Ital. Sci. Nat. Mus. Civ. St. Nat. Milano,* 128: 305-313.

Centro Studi Cetacei, 1988 - Cetacei spiaggiati lungo le coste italiane. II. Rendiconto 1987 (Mammalia). *Atti Soc. Ital. Sci. Nat. Mus. Civ. St. Nat. Milano,* 129: 411-432.

Clarke M. R., 1966 - A Review of the Systematics and Ecology of Oceanic Squids. *Adv. Mar. Biol.,* 4: 91-300.

Clarke M. R., 1986 - A Handbook for the Identification of Cephalopod Beaks. *Clarendon Press,* Oxford: XIII + 273 pp.

Desportes G., 1985 - La nutrition des Odontocètes en Atlantique Nord-Est (côtes Françaises - iles Feroë). Doctoral thesis, *Université de Poitiers,* France: XII + 214 pp., 7 appendixes.

Duguy R., Casinos A. & Filella S., 1979 - Note sur la biologie de *Stenella coeruleoalba* dans le bassin occidental de la Méditerranée. *Rapp. Comm. int. Mer Médit.,* 25-26, 10: 137-139.

Froglia C. & Giannini S., 1982 - Osservazioni sugli spostamenti verticali nictemerali di *Sergestes arcticus* Kroyer e *Sergia robusta* (Smith) (Crustacea, Decapoda, Sergestidae) nel Mediterraneo occidentale. *Atti Conv. UU.OO. afferenti ai sottoprogetti Risorse Biologiche e Inquinamento marino, P.F. Oceanografia e Fondi marini,* Roma: 311-319.

Gibbs R. H. Jr., 1984 - Chauliodontidae. In P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (eds.), Fishes of the North-eastern Atlantic and the Mediterranean. Vol. 1. Unesco, Paris: 336-337.

Holthuis L. B., 1987 - Crevettes. In W. Fischer, M.-L. Bauchot & M. Schneider (eds.), Fiches FAO d'identification des espèces pour les besoins de la pêche. (Révision 1). Méditerranée et mer Noire. Zone de pêche 37. Vol. 1. *FAO,* Rome: 189-292.

Mangold K. & Boletzky S. v., 1987 - Céphalopodes. In W. Fischer, M.-L. Bauchot & M. Schneider (eds.), Fiches FAO d'identification des espèces pour les besoins de la pêche. (Révision 1). Méditerranée et mer Noire. Zone de pêche 37. Vol. 1. *FAO,* Rome: 633-714.

Miyazaki N., Kusaka T. & Nishiwaki M., 1973 - Food of *Stenella coeruleoalba. Sci. Rep. Whales Res. Inst.,* 25: 265-275.

Norris K. S., 1991 - Dolphin Days. *W. W. Norton & Co.,* New York & London: 73-82.

Pastore M., 1976 - Note ittiologiche del Golfo di Taranto. I. Generalità e lista delle specie. *Oebalia,* 2: 91-103.

Roper C. F. E., 1974 - Vertical and Seasonal Distribution of Pelagic Cephalopods in the Mediterranean. Preliminary Report. *Bull. Am. Malacol. Union Inc.,* May 1974: 27-30.

Viale D., 1985 - Cetaceans in the Northwestern Mediterranean: Their Place in the Ecosystem. *Oceanogr. Mar. Biol. Ann. Rev.,* 23: 491-571.

Wurtz M. & Marrale D., 1991 - On the stomach contents of striped dolphins (*Stenella coeruleoalba* Meyen, 1833) from the Ligurian coast, Central Mediterranean Sea. *Europ. Res. Cetaceans,* 5: 62-64.

Young R. E., Kampa E. M., Maynard S. D., Mencher F. M. & Roper C. F. E., 1980 - Counterillumination and the upper depth limits of midwater animals. *Deep-Sea Res.,* 27A: 671-691.

Young R. E. & Roper C. F. E., 1976 - Bioluminescent Countershading in Midwater Animals: Evidence from Living Squid. *Science,* 191: 1046-1048.